Mineral Deposit Prevention and Removal by Electro-magnetical Treatment

For pipe diameters up to 3 m (120”)

Problems caused by minerals in water

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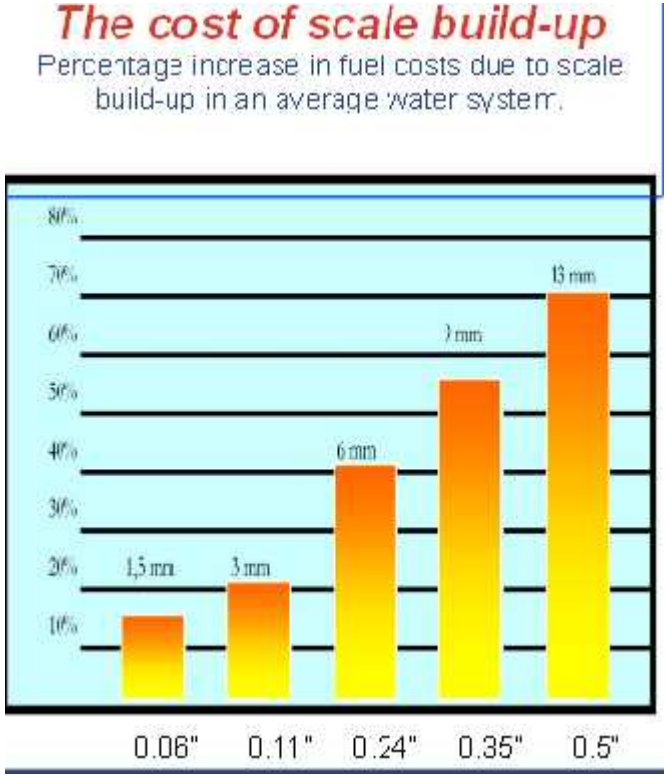
Adverse effect of mineral scaling:

- Pressure in pipe lines Pressure increases, therefore pumps have to work harder and consume more energy
- Heat transfer. A 10 % increase in energy demand is caused by a 1 mm scale thickness on the heating surface to achieve the same temperature as without scaling.
- Bacteria/Biofilm/Algae. Calcium layers and algae growth are a breeding ground for bacteria.
- Corrosion.

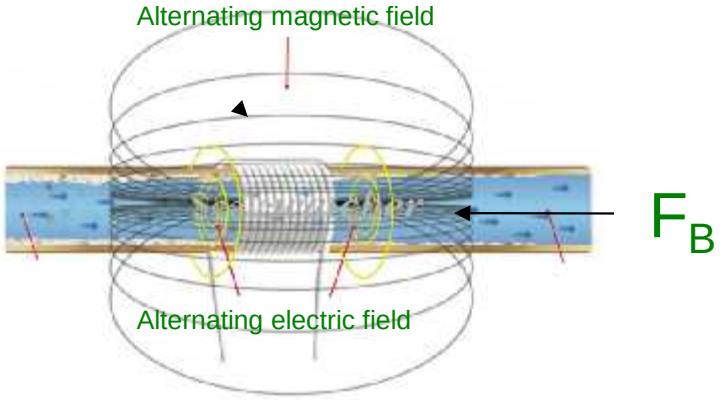
The treatment has a positive effect on the above mentioned adverse effects by influencing crystal growth in the water. Old hard layers will be gradually softened and carried away by the flow of water.



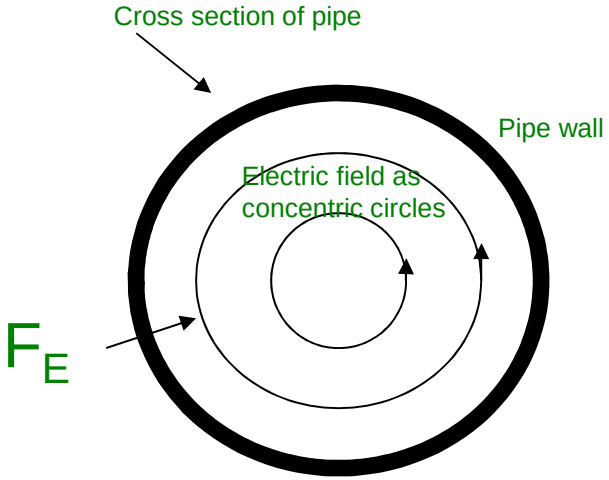
Physical explanation

The effect of magnetic and electric fields on charged particles

Water contains dissolved mineral crystals and the mineral crystals itself. Among them are Calcium- and Carbonate ions, which are interacting to form an equilibrium with Calcium Carbonate crystals. Meaning that when crystals are dissolved other mineral ions will combine and form crystals again. This is a continuous process. The force of an electric and magnetic field of the right frequency and signal-shape influences this process, shifting the equilibrium towards much more crystals of smaller size and roundish shape. This is the base for the SW effect, as these crystals do not stick to pipe walls.



$F_T=F_E + F_B$ and is the total force on a charge moving in an electric and magnetic field



The alternating fields are generated by an alternating current with continuous changing frequencies within a specific band.

Evidence of theory

Pictures taken with an electron microscope

822 x magnified

Note the matted structures that Calcium Carbonate forms in untreated water. These "mats" stick even on smooth surfaces and offer newly formed $CaCO_3$ crystals a lot of places to attach to. This is the very base of scaling!

8430 x magnified

Note that the crystals are smaller and have a rotund shape, which means that they have a larger volume in relation to a smaller surface. This feature makes them sensitive to water currents and they are easily flushed out of the pipeline.

Evidence of theory

Close up showing the difference between untreated and treated crystals as to shape and size.

Pictures have been taken with an electron microscope at a university in Germany on request of Scalewatcher.

Not treated: Crystals have sharp edges and a large surface, which eases adhesion to pipe walls.

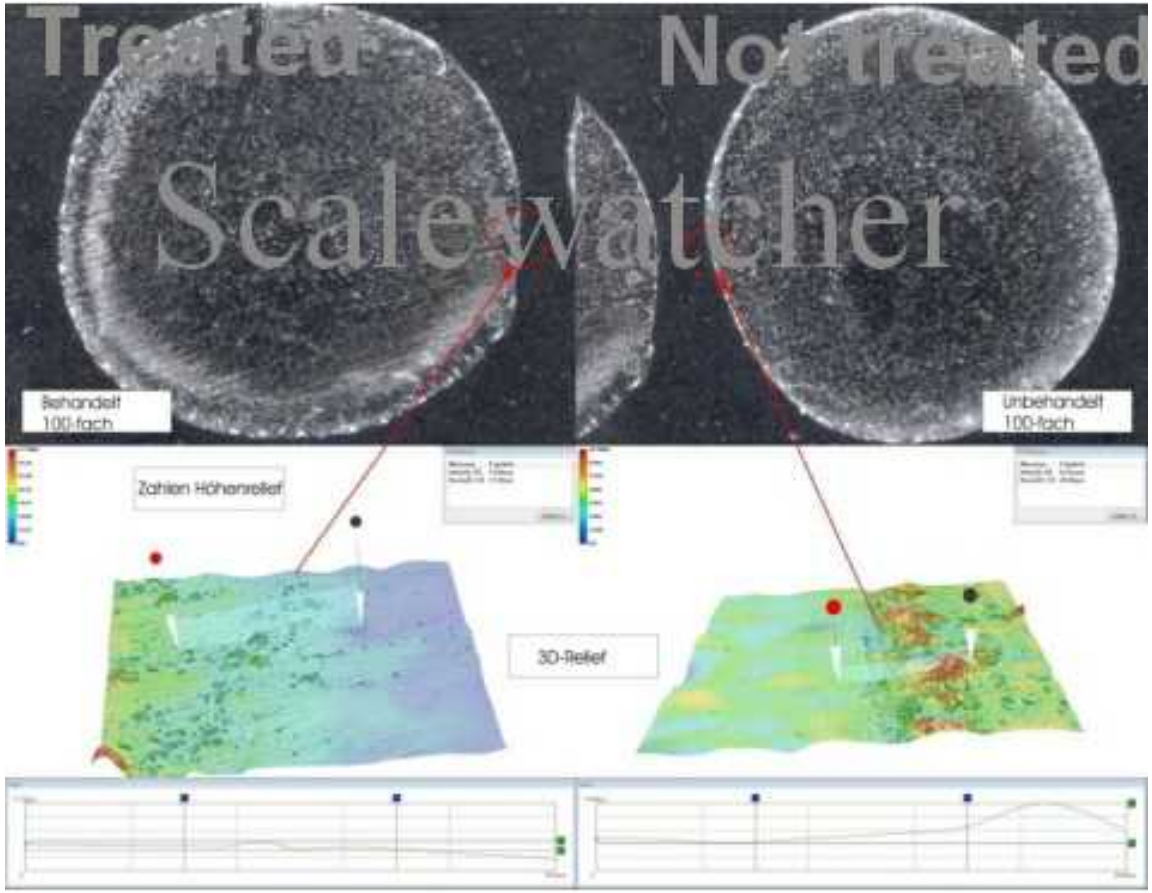
Treated: Crystals are smaller and have roundish shape. They have less tendency to adhere to pipe walls.

It must be noted that the pictures of the 2 micron sized crystals have been taken some time after treatment. One can expect that the initial size is in the nano range and that the crystals grow out to a larger size over time.

Once the size of 2 micron is reached the crystals can be filtered out. However when one filters the water right after treatment filtering is not possible as the crystals are still in the nano range and need time to grow.

Evidence of theory

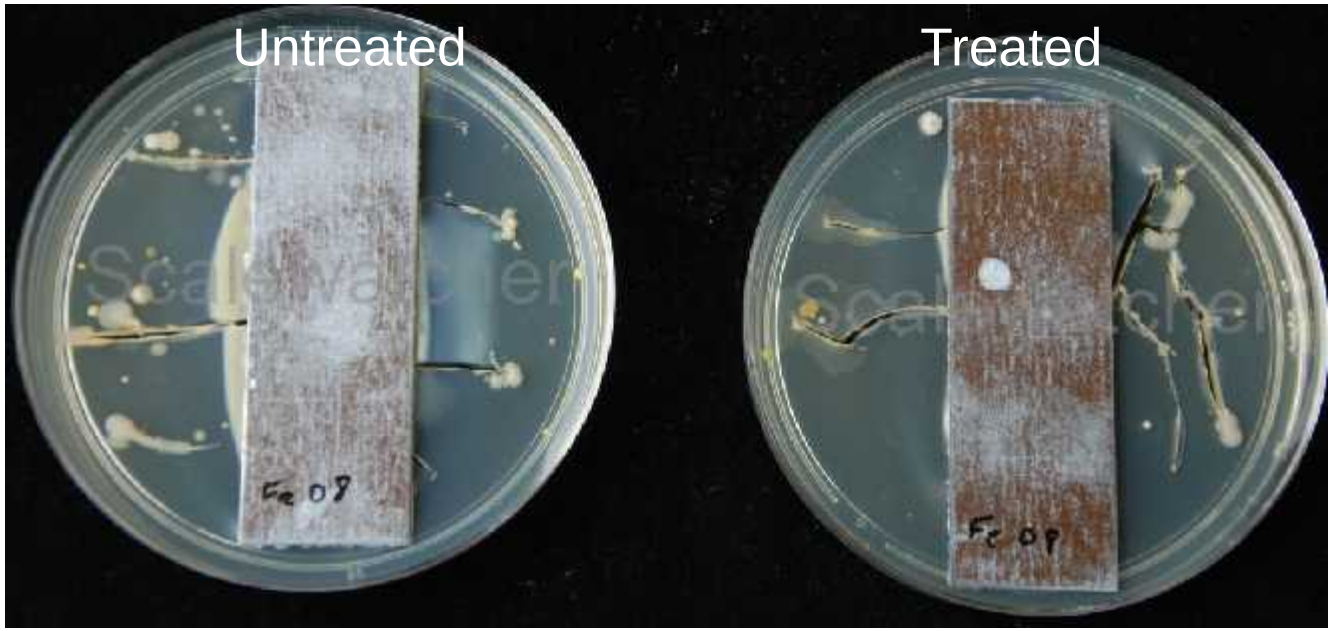
Pictures taken with a three dimensional (3D) microscope



The 2D-cut through the 3D-pic shows the matted structure in the boundary region of the untreated drop (right), where the particles stick together and overlay each other to more than 10 micrometers. In contrary, a cut through the boundary of the treated drop (left) shows singular, scattered crystals of about 3 micrometers size.

Laboratory test

Effect on bacteria growth



Iron test plates in a basin filled with stagnant treated or untreated water. Pictures taken three days after the inoculation of bacteria. Normal chlorinated tap water is used of 20 ° C.

Difference between treated and untreated water:

- SW-treated bacterial colonies grow much slower than not treated.
- Spreading of colonies is also much less.
- Bacterial colonies avoided settlement on the metal iron plate.

Laboratory test

Effect on bacteria growth

Iron test plates in a basin filled with stagnant treated or untreated water. Pictures taken three days after the inoculation of bacteria. Normal chlorinated tap water is used of 20 ° C.

Bacteria were inoculated in untreated water to breed for three days. (Left). After three days the water with bacteria was treated and the difference observed and pictured after two days.

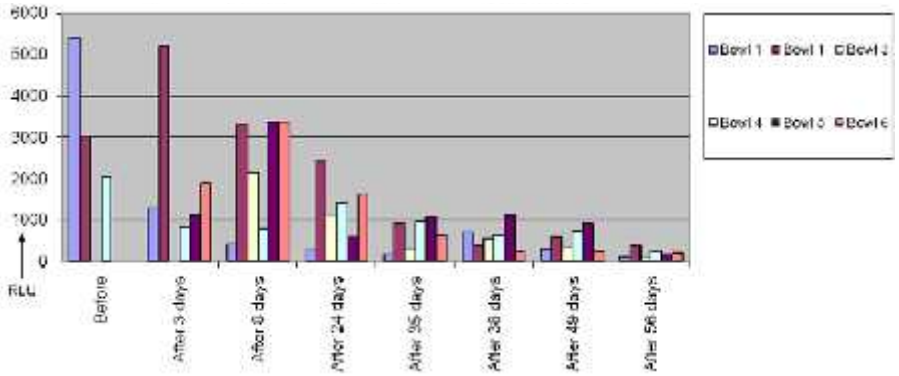
The difference is obvious. The bacteria are dying. This test simulates the real world where bacteria are growing in galvanized iron pipes. (Private houses, elderly homes, hospitals etc…)

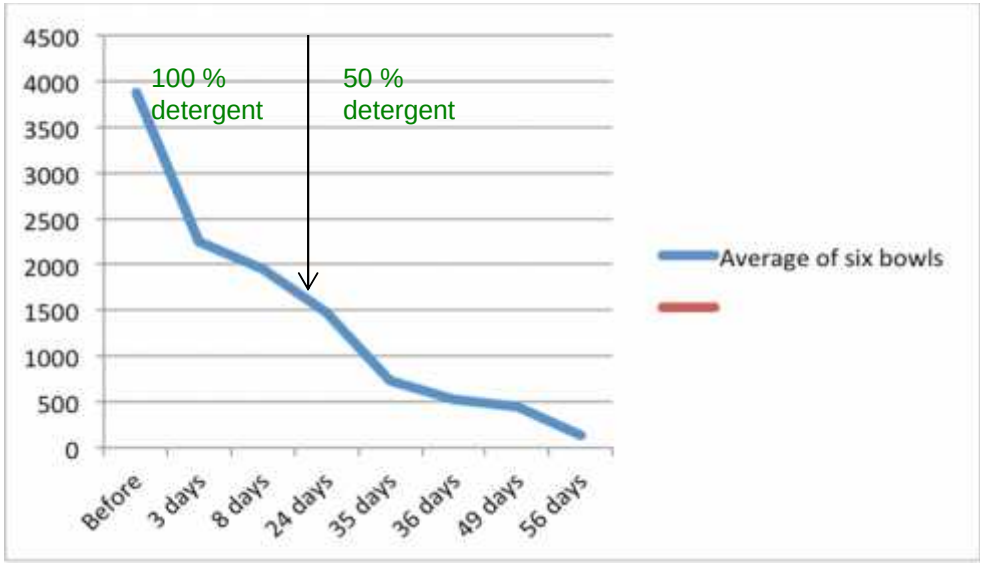
- These tests support scientifically what users reported for a long time:
- Cooling water of cooling towers becomes transparent and does not smell anymore.
- Bio-film disappears
- Animals prefer to drink treated not untreated water.
- Swimming pools can use less chemicals for killing bacteria
- Dishwasher leave less bacteria on bowls and other cutlery.

Field test

Effect on bacteria growth on the cleaning properties of a dishwasher

Effect of Scalewatcher on the cleanliness of a dishwasher





Six bowls of the kitchen of a hospital were given a mark with the numbers 1 to 6, cleaned by de dishwasher and the next 56 days every day used and cleaned again.
Before this experiment the bacterial activity was measured with an ATP meter and was on average 3800.
Scalewatcher was installed and one can see that the living material decreases rather quick.
After 24 days 50 % less detergent was used in the dishwasher.
One can see that the bacterial activity is insignificant after 56 days.
Of course this is valid for any surface cleaned by Scalewatcher treated water repeatedly.
There does not exist cleaner cutlery in restaurants, elderly homes and hospitals when the water is treated with Scalewatcher.

Part of the Scalewatcher expertise are not only the application reports from thousands of satisfied customers worldwide, but also a comprehensive scientific work on the Scalewatcher effect to support product development. The microscopic pictures are one part of it. According to our knowledge, this was the first time that all modern microscopic methods were simultaneously used in this field of water research. The results are convincing, as the different methods are applied to different effects of the Scalewatcher treatment.

- Optical/ polarization microscopy: particle shape and distribution
- 3D digital microscopy: particle size and structure
- Scanning electron microscopy: crystal form and crystallization structure

General equipment in Industry or Commerce where this physical water treatment can be used

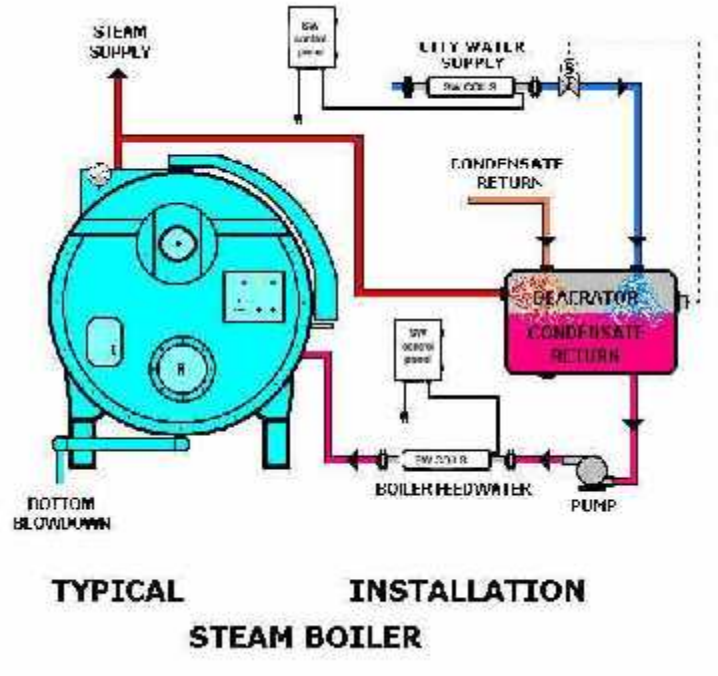
- Cooling towers – Chillers
- Compressors
- Water boilers
- Fire tube steam boilers
- Plate heat exchangers
- Shell and tube heat exchangers
- Pipe lines
- Evaporators
- Condensers
- Aerators
- Air coolers
- Oil coolers

The treatment can be used for:

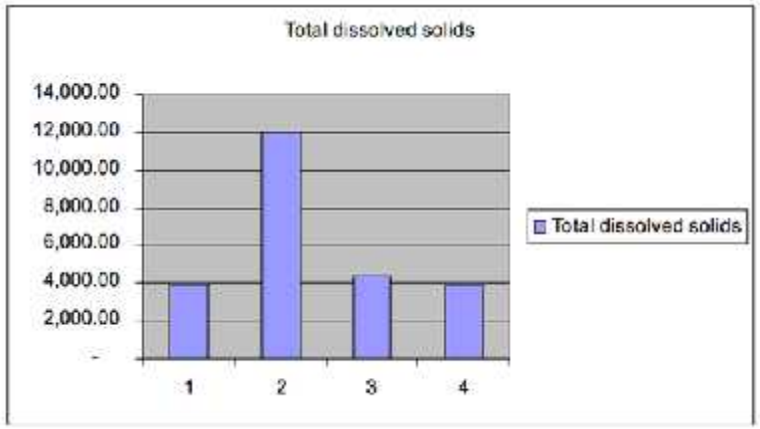
- Removing and Preventing scale deposits, rust, barnacles, slime
- Preventing settlement of zebra mussels.
- Reducing bacterial count in cooling towers amongst others
- Reducing or completely inhibiting algae growth.

General equipment in Industry or Commerce where this physical water treatment can be used

Fire tube steam boiler



TDS level change of blow down water after installation of Scalewatcher



1: Before, 2: After 15 days, 3: After 30 days, 4: After 60 days

Advantages:

- Savings on energy, water, chemicals and maintenance.
- Less corrosion, as less often acid cleaning is needed of the fire tubes.
- Lower body temperature
- Dryer steam

WARNING: Existing water treatment cannot be switched off after installation of Scalewatcher. Both should work together. Once it is noticed that the blow down water gets dirty one knows the treatment has effect and the boiler is being cleaned out. At the same time the TDS level should sharply increase. Therefore the TDS level should be measured daily and when it increases more blow down should be applied to keep the level down. When the TDS has the normal value again after a few weeks, the customer can decide to decrease the old water treatment while observing pH and TDS daily.

General equipment in Industry or Commerce where this physical water treatment can be used

Effect on shell and tube heat exchanger

Process water inside tubes 180 ºC
Cooling water outside tubes ambient temperature
Scaling after six months without SW

Completely clean after being treated with SW during six months

General equipment in Industry or Commerce where this physical water treatment can be used

Plate heat exchanger

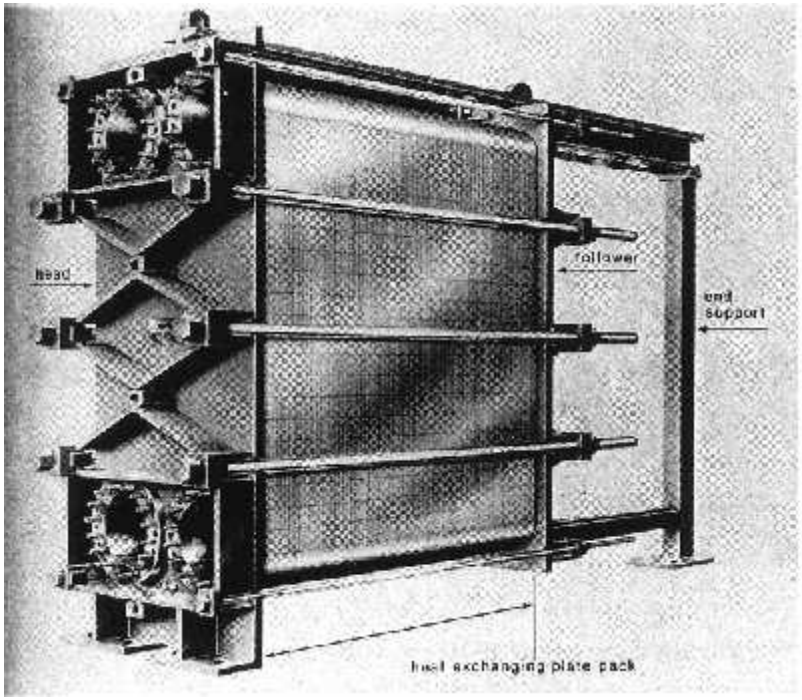


Plate heat exchangers are difficult to treat caused by the low flow velocity between the plates. On a circulation system Scalewatcher will have a better effect than on a one pass system.

This treatment needs flowing water to be able to remove old scale layers. As the water is distributed over a large surface the flow velocity may be too low to remove old scale layers.

General equipment in Industry or Commerce where this physical water treatment can be used

Typical cooling tower installation

SW2 treats the closed loop of the chiller. As heat transfer properties are better with treated water this is beneficial.

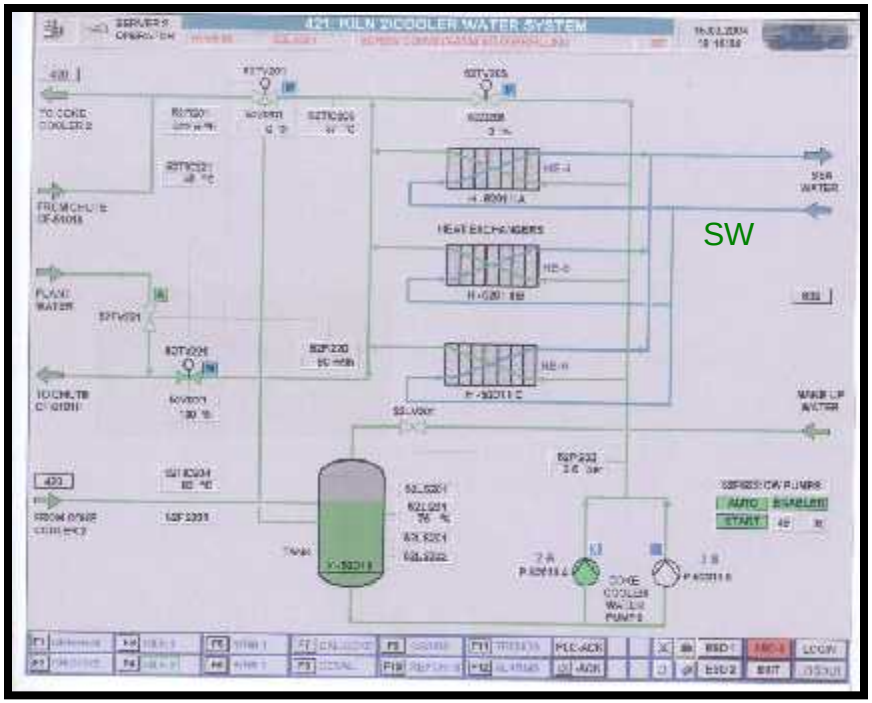
It was reported that a hotel with 350 rooms, the guests were not complaining about the air conditioning for the first time in 20 years.

It was reported that a 500 tons cooling tower saved $17,500 on water alone annually. Not to speak about less cost for discharge, maintenance and chemicals.

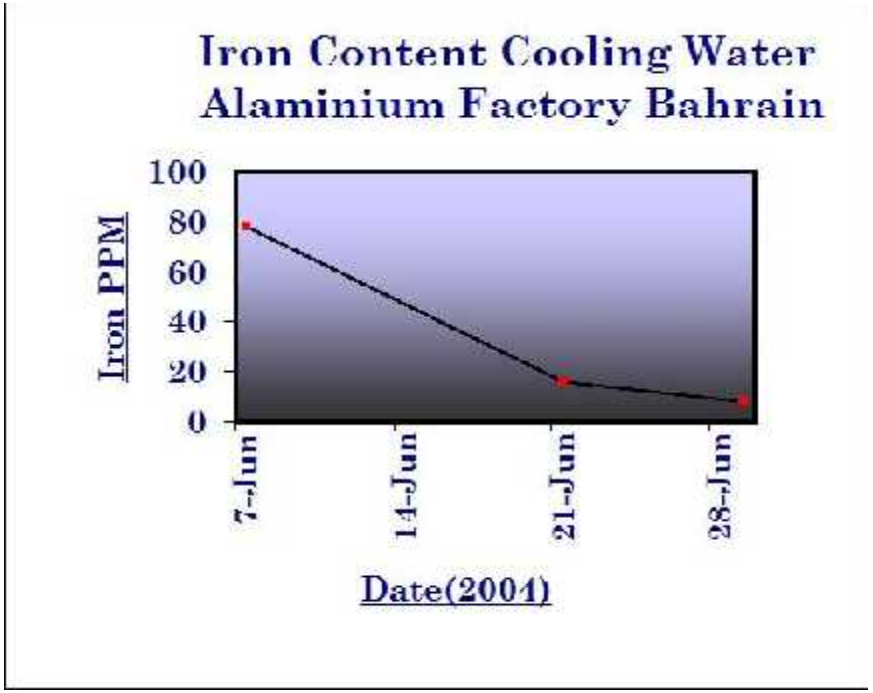
SW1 will treat the cold water, keeping the chiller and cooling tower scale free, reducing bacterial count, reducing slime and algae, while saving water. Water can be saved as less or no chemicals are used to treat the water, which otherwise will rapidly increase the TDS, making blow down more often necessary. Water savings of 50 % or more is possible.

General equipment in Industry or Commerce where this physical water treatment can be used

Effect on corrosion (Alba aluminum factory, Bahrein)



Seawater is used for cooling purposes in heat exchangers. The problem was heavy corrosion as can be expected from sea water.



Within two weeks the corrosion was significantly reduced

General equipment in Industry or Commerce where this physical water treatment can be used

Effect on corrosion in pipe lines

Water, Oxygen and iron pipes create rust. Within a few weeks the rust disappears and the pipe wall will be covered by a very thin Black layer called Magnetite. The layer will not grow in thickness over time and has very good heat transfer properties which is beneficial for steam boilers and heat exchangers.

Summary of advantage of this type of treatment

- ✓ Prevents further built up of scale layers
- ✓ Removes old scale layers
- ✓ Improves heat transfer properties of water
- ✓ Improves cleaning properties of water
- ✓ Reduces or prevents bacteria growth
- ✓ Reduces or prevents algae growth
- ✓ Reduces corrosion
- ✓ Removes rust and replaces it with a Black layer called Magnetite
- ✓ No chemicals needed to operate
- ✓ Guaranteed to work
- ✓ Energy consumption insignificant
- ✓ No maintenance
- ✓ Friendly for the environment
- ✓ Easy to install
- ✓ Quick return on investment
- ✓ Lifespan more than 20 years
- ✓ Non invasive

Can be applied successfully in house holds, commerce and Industry

Product assortment

Households, ponds and private swimming pools

Nano

3 Star US

3 Star

4 Star

5 Star

For all pipe material and pipe size as usually found in private houses

Model	SW Nano	3 Star	4 Star	5 Star
Well water	N	N	Y	Y
Outdoor use	N	N	N	Y
Large house	N	Y	Y	Y
Warranty	2 years	10 years	10 years	10 years
Performance guarantee	4 months	one year	one year	one year

Product assortment

Commercial

Models CM2 and CM4 for indoor use

For use in, but not limited to:

- Restaurants,
- Small buildings,
- Beauty parlors
- Bed & Breakfast
- Swimming pools
- Dentists

Models CMN2, CMN4 and CMN8 heavy duty.

- Small buildings
- Carwashes
- Ponds
- Small slaughterhouses
- Swimming pools
- Green houses
- Municipal water supply
- Golf courses

Product assortment

Industrial

Light Industry
IE series

IE2, IE4 and IE8

Heavy Industry, SE, LE and HIME series

SE4, SE8, LE12, LE16

HIME24, HIME40, HIME60, HIME80

- Buildings
- Slaughter houses
- Poultry farms
- Dairy farms
- Food Industry
- Garment Industry
- Beverage Industry
- Nurseries
- Agriculture

- Paper factories
- Steel factories
- Waste water plants
- Power plants
- Aluminum factories
- Mining
- water supply
- Petro Chemical Industry
- Crude oil production
- Municipal